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ABSTRACT

Since 1983, discussions focused increasingly on the contribution to economic performance associated with the skills of the work force. Government policy went further by specifying skills important to economic performance and advocating their introduction into schools and training programs. Surprisingly little empirical research examined the importance of specific skills and their relationship with performance. A study examined self-reported skill needs across a range of job settings. Eight public utilities agreed to cooperate in the study, which examined workers across 15 jobs in each company. The companies identified benchmark jobs, common to all the companies and easily identifiable in the outside labor market. Skill issues were assessed by plant managers, workers, and their supervisors. Managers and supervisors were chosen at random. Each supervisor reported a series of performance measures for each employee. Employees were surveyed and rated about skill issues, work organization, and job attitudes. The response rate was 100 percent from supervisors and 85 percent from employees. Results suggested that basic skills associated with academic learning were especially important to performance in the workplace. These skills were perceived as more important for improving performance by both employees and supervisors, whereas the perceived need to improve these skills was associated with more positive attitudes and behaviors. (Contains 9 endnotes, 34 references, and 8 tables.) (YLB)

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NATIONAL CENTER ON ADULT LITERACY

SELF-ASSESSED SKILL NEEDS AND JOB PERFORMANCE

Peter Cappelli
Nikolai Rogovsky
National Center on the Educational Quality of the Workforce
University of Pennsylvania

NCAL TECHNICAL REPORT TR94-08
JANUARY 1995

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SELF-ASSESSED SKILL NEEDS AND JOB PERFORMANCE

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Abstract

Recent discussions about competitiveness have increasingly focused on the contribution to economic performance associated with the skills of the workforce. Government policy has gone further by specifying the skills that are important to economic performance and advocating their introduction into schools and training programs in the United States and other industrialized countries. There has been very little empirical research that examines the importance of specific skills and their relationship with performance. This report presents new data obtained directly from workers and their supervisors about the importance of various skills and their contribution to job performance. The results suggest that basic skills associated with academic learning are especially important to performance in the workplace. These skills are perceived as more important for improving performance by both employees and supervisors—deficits in them are associated with poorer overall job performance, while the perceived need to improve these skills is associated with more positive attitudes and behaviors.

INTRODUCTION

The beginning of the contemporary concern about skills and economic competitiveness in the United States came perhaps with the government report, *A Nation at Risk* (National Commission on Excellence in Education, 1983), which documented the poor academic performance of U.S. students compared to those of major competitor nations. Studies such as Baumol, Blackman, and Wolff (1989) focused attention on the long-run and comparative performance of the U.S. economy. Piore and Sabel (1984), Cohen and Zysman (1987), and others drew attention to the importance of production work to an economy and to the fact that work organization and employee skills influenced the competitiveness of manufacturing firms and their ability to adapt to changing markets.

Dertouzos, Lester, Solow, and the MIT Commission on Industrial Productivity (1989) developed these views into an argument about declining U.S. competitiveness that became virtually a touchstone for future studies. The work organization and management structures of U.S. firms rely too much on outdated scientific management approaches. They are hierarchical, based on narrow job titles and unskilled workers, and, as a result, are not as flexible in adjusting to changing markets as the competitor firms in other countries. The more flexible techniques of Japanese management in particular demand higher skills from the labor force.

Other studies soon pounced on the connection between skills, productivity, and economic performance. Both *America's Choice* (1990) and the Office of Technology Assessment's report (1990) argued that higher levels of skills in the workforce were necessary in order to develop the new, more productive systems of work organization and compete successfully with other nations.

With these reports as a backdrop, the Secretary of Labor's Commission on Achieving Necessary Skills (SCANS) was established in 1990 to identify the skills that the workplace was demanding. In its various reports, the Commission has argued forcefully that new types of organizations and new arrangements for organizing work—employee empowerment, teams, and new work technologies—require new skills and a higher level of existing skills from workers. Furthermore, the skills that are required are at least in part general work skills that translate across employers and industries. Both employers and individual workers are seen as benefiting from those higher skills (SCANS, 1992).

Arguments like these have in large measure been responsible for a new thrust in public policy toward raising skill levels, especially through schooling. The National Goals for Education, for example, is an effort to raise educational standards in the country at least in part to improve competitiveness. The list of skills identified by SCANS as reasonably generic to the U.S. economy has been used to drive the curriculum in high schools and in training programs such as the Job Corps and those funded by the Job Training Partnership Act (SCANS, 1992, pp. 1-4). The School-to-Work Opportunities Act, passed by Congress to establish school-to-work transition programs like youth apprenticeships, is also designed to raise work-related skills.

SKILLS AND INDIVIDUAL PERFORMANCE

Given the speed with which these arguments have moved forward, it is indeed surprising to find so little empirical research that examines the relationship between skills, worker productivity, and economic performance. It is not obvious, in the absence of empirical evidence, that higher levels of skills will necessarily lead to improved economic performance. Unless jobs require or allow workers to make use of higher skills, for example, one should not expect performance to improve when skills increase. Further, jobs that require higher levels of skills now than in the past still may not tax the skills that employees already have. In assembly jobs, for example, the initial skill requirements are so low that they could rise substantially and still be within the set that virtually all workers possess. Finally, where skills are in deficit, the relevant skills may be job-specific ones that are typically seen as being the responsibility of the employer to provide.

Perhaps the main reason for the lack of research on skills and performance is the difficulty in obtaining direct measures of an employee's skill. What is typically available are aggregate measures of the amount of education and training workers receive. These are the inputs that should produce skill and that are related to indirect measures of performance.

The body of research on the economic returns on education is particularly extensive and may have some relevance for these questions. Human capital research clearly finds that employees with more education earn more, suggesting that the skills they have are valued in the market. Whether education is simply a proxy or screen for some other desirable characteristic, such as perseverance, is a complicating factor in the argument. The fact that the return on education appears to be rising over the past decade—rising rapidly for college graduates and falling sharply for high school dropouts—suggests that such education is increasingly valuable in the labor market (cf. Levy & Murnane, 1992).

The fact that both initial and further education and training earn a higher return suggests that some of the skills associated with education are increasingly valuable (see Tuijnman, 1992, for references to research in Colombia, the Netherlands, Sweden, Norway, and the United States). But for which specific skills is the return being earned? Research on the relationship between vocational course work and subsequent job performance may shed some light on this question. Vocational education programs typically provide training for specific occupations, and research on the labor market outcomes for students in these programs can help in understanding the effects of general or vocational skills on the economy. Altonji (1992) found that students who took more vocational courses earned higher wages, other things being equal. Other studies find that enrollment in vocational education programs improves participants' labor market experience but only for those who find jobs in the field for which they received training (e.g., Campbell, Eliot, Laughlin, & Suesy, 1987). High school students who participate in vocationally oriented programs like work-study and co-op substitute on-the-job training for academic classes, and

studies suggest that they do not necessarily do better in the labor market than those who did not participate in such programs (Bishop, Blakemore, & Low, 1985). Hollenbeck (cited in Stern, Stone, Finkelstein, Latting, & Martinez, 1993) found that students enrolled in occupationally based technical training following high school did better in the labor market than did those who pursued a baccalaureate program.

It is difficult to draw consistent conclusions from these studies about the skills needed to improve economic performance (Berryman, 1994; Stern & Tuijnman, in press). The fact that vocational skills pay off when graduates find jobs in their field of training but not otherwise may indicate, for example, that the programs help simply by giving access to a well-paying job market. In one of the few studies that attempts to sort out the source of higher wages, Grubb (1991) concludes that the return on a two-year college degree comes mainly from access to better paying occupations than are available to nondegree workers and not from obtaining higher paying jobs within the same occupation. The latter measures the extent to which education produces higher performance for the economy as a whole.

The complication noted above about interpreting evidence on returns from education is that education may function as a screen for some other desirable characteristic, such as persistence, that covaries with educational attainment and drives success. One way around this problem is to examine individuals' skills directly, as opposed to their educational attainment. Bishop's (1991) comparison of workers' wages with their scores on the Armed Services Vocational Aptitude Battery is one example of this approach. He finds that higher competencies were not associated with higher starting wages.[1] Basic academic competencies such as mathematical ability actually received a negative premium from the labor market while vocational skills such as typing speed earned a substantial premium. These competencies were related, however, to performance on the job as measured by the reports of supervisors.

SCANS conducted its own, albeit indirect, test of the relationship between skills and performance by examining the prevailing wages for a sample of jobs and the SCANS competencies associated with them (SCANS, 1992, p. 9). Not surprisingly, it was found that jobs requiring higher skills pay more. As noted above, however, it is not clear what to conclude from this. It does not indicate, for example, that workers with higher skills perform better in the same job or that the economy would be better off if skills levels rose.

A second complication about interpreting evidence from the economic returns on skills as measured by wages is that such skills raise wages in two ways. The first is by providing access to higher paying occupations, and the second is by helping improve performance within occupations. The policy interest associated with the arguments above is mainly with the second relationship. While jobs in medicine, for example, require higher skills and pay individuals more, the economy as a whole cannot grow by making more and more people into doctors. Even for individuals, the gains from expanding access to higher wage occupations face the well-known fallacy of composition: If the supply of workers with the skills needed to fill a particular job rose, the wages associated with that job would fall, as would its desirability. Performance and wages can grow, however, if all workers become more productive at their current jobs.

An alternative approach, therefore, is to examine the relationship between skills and job performance within one's current job, using actual job productivity measures for the estimates. Most of these studies come from personnel psychology where they form the basis of attempts to validate selection procedures (see, e.g., American Psychological Association, American Educational Research Association, & National Council on Measurement in Education [Joint Committee], 1985).

Studies of skills that might generalize across settings concentrate mainly on academic material of the kind associated with classroom instruction. Academic skills as measured by aptitude tests can be reasonably good predictors of job performance (cf. Barrett & Depinet, 1991). The best known of these tests is the General Abilities Test Battery (GATB), which is used extensively by the employment service. The cognitive composite scale from GATB measures traditional academic skills such as verbal and numeric skill. It is related to job performance at roughly the same level as vocational skills, which correlate at levels between .20 and .30 (see National Research Council, 1989). Academic performance as measured by grades in school, however, is a substantially worse predictor of job performance (cf. Hunter & Hunter, 1984; Schmitt, Goodling, Noe, & Kirsch, 1984).

Other studies use organizational performance measures to examine the relationship with skills. Bartel and Lichtenberg (1987) find, for example, that the rate of innovation is higher in industries that have more educated workers. Cohen and Levinthal (1990) also find that firms that have made a greater investment in learning experience greater innovations.

Overall, the results surveyed above suggest that job performance—and ultimately economic performance—might be improved by raising academic skills in the workforce as a whole.[2] With respect to the policy arguments above, however, it is not clear which skills are the important ones for performance or whether new work systems are creating higher demands for skills.

ESTABLISHING RELEVANT SKILLS

SCANS essentially performed a job analysis for the economy as a whole, producing a set of basic skills that are said to generalize across virtually all jobs in the workplace. While all job analyses are somewhat subjective, the SCANS skills are similar to those generated by other widely used job analyses such as the Position Analysis Questionnaire (McCormick & Jeanneret, 1988). SCANS identified two categories of these general skills: *foundation skills* associated with traditional academic education and interpersonal skills, and *workplace competencies*, which are more practical and vocational, applying skills to a workplace context.

The publication of the SCANS skills and the effort to have these skills institutionalized in curricula create a need to examine the general relationship between skills and performance as well as the specific arguments put forward in the policy debate. Specifically, are these skills related to actual performance, and what is the relative importance of the different skills; do the

more academically based skills or the vocational skills have a bigger impact on performance? The results have powerful implications for the reform of education in the United States, particularly concerning curricula. While it is certainly possible to argue about the merits of the SCANS skills—whether important skills have been left out or those that are included have been accurately classified—the fact that these skills have become a part of the public policy debate makes it important to examine them.

A related question is, what factors (if any) are creating a need for higher skills? Are the new systems of work organization associated with high-performance work creating a need for higher skills, and, if so, what are those skills? To our knowledge, there have been very few attempts to examine the relationship between general skills and actual performance and no efforts other than case studies to examine the relationships between new work systems and skills demands.

MEASURING THE SKILL NEEDS OF INDIVIDUALS

If one had a perfect job analysis describing the skill requirements for each position and a perfect assessment of the skills that each job incumbent had, the difference between these two measures would be the skill needs of each individual. Especially in large organizations, formal needs assessments are used to assess skill needs and are an important component of training and development programs. Saari, Johnson, McClaughlin, and Zimmerle (1988) report that 27% of the companies they surveyed had formal procedures for assessing the skill needs of their managerial employees.

Some needs assessments evaluate the skills of employees and then compare them to job requirements in order to estimate skill needs. Because both the job requirements and the skills assessments can be problematic measures, it is much easier to obtain information on skill needs directly.[3] Such assessments sometimes are based on job performance measures (the assumption that poor performance is driven in part by inadequate skills). But increasingly, the most popular approach is to ask employees directly about their skill needs.

Certainly job incumbents have the best information about their own skills and what their job in fact requires. The question is whether incentives to misreport information or perceptual biases in the processing of that information create more error than one would find in other measures. A summary of the validity research on self-reported needs assessments suggests, on the one hand, that they tend to underreport skill needs relative to other expert raters (Holzbach, 1978) but, on the other hand, they are less biased by halo effects (which assume that incumbents with good performance evaluations have higher skills) than other raters (Klimoski & London, 1974). In general, however, self-reports are significantly related to performance outcomes as measured by test scores or actual job performance. More important, the relationships are at least as strong as with other measures of skill needs (see Ford & Noe, 1987, for a review of the relationships with performance).

THE DATA AND STUDY DESIGN

This study examines self-reported skill needs across a range of job settings. Eight public utilities agreed to cooperate in the study, which examined workers across 15 jobs in each company.[4] The companies identified the jobs that were to be examined. These were *benchmark jobs*, common to all the companies and easily identifiable in the outside labor market. They span a range of positions from craft, clerical, supervisory, and managerial work. The jobs are not necessarily unique to utilities, although it is accepted that the industry context may exert some unique influence on skill requirements. Specifically, public utilities are among the best paying, most stable employers in their communities and may well have their pick of the best available workers with the highest overall level of skills. The employees may have higher skills than those elsewhere, and it is possible that the jobs are adjusted somewhat to make use of those higher skills.

Skill issues were assessed by plant managers, by workers, and by their supervisors. The managers and supervisors were chosen at random from within the companies. The supervisors were selected according to the benchmark jobs they oversaw with one supervisor for each job. Each supervisor reported a series of performance measures for each of those employees. Where they supervised more than 10 employees, they selected at random up to 10 on whom they reported. The employees were then surveyed and rated about skill issues, work organization, and job attitudes. The response rate was 100% from supervisors (no doubt because their superiors ordered them to respond) and 85% from employees. A total of 91 supervisors responded, and there were 553 usable matched responses between supervisors and employees.

ANALYSIS

PERCEPTIONS OF SKILL NEEDS

Table 1 (see Appendix) describes the specific items in the SCANS skills framework and reports the perception of employees concerning the importance of those skills to improving performance on their job. The question asks employees how important additional training in each skill area would be to improving their job performance. The most important finding is that the employees believe that foundation skills, those associated with more traditional, school-based education, are significantly more important than workplace competencies, which represent more vocational or work-based skills. A nonparametric Wilcoxon test finds that the difference in rankings between these sets of skills is significant at the 5% level (two-tailed tests). Within workplace competencies, the first three, which stress interpersonal skills, are seen as considerably more important than the remaining skills.

Table 2 (see Appendix) asks the same question of supervisors about the skills that their subordinates need. The supervisors believed that almost every

skill was more important than did their subordinates, although the rankings of the relative importance of the skills in the two tables are remarkably similar.[5] This convergence contrasts with other studies, which often find a lack of relationship between self-reports of skills needs and the evaluations of others (e.g., Holzbach, 1978). One difference here is that the margin by which foundation skills were seen as more important was substantially greater for the supervisors. Again, a Wilcoxon test suggests that the difference in rankings between the two sets of skills is significant at the 5% level.

The questions in Tables 1 and 2 ask about the skills that are necessary to improve job performance. Table 3 (see Appendix) asks the supervisors a slightly different question—to assess deficiencies in their subordinates' skills. The question may capture more accurately those situations where skills are inadequate for meeting minimum or required levels of performance. Here, workplace competencies come out as significantly more important. The rank order correlation (Spearman) between the supervisors' assessments of skills importance and skills deficits was -.69 (significant at the 1% level), suggesting that the more important a skill is, the less deficient it is.

Plant managers were also asked about the deficiencies of their employees. Their responses are reported in Table 4 (see Appendix). Foundation skills come out as in greater deficit for both new hires (who have less than two years of service) and veteran workers (who have at least two years of service). Perhaps most important, both foundation skills and workplace competencies are seen as being in greater deficit for "veteran" workers than for new hires. Short of some rapid improvement in the skills that entry-level workers have brought to their jobs in the past two years, these results appear to suggest that skill deficits are more noticeable once workers are in their jobs for a while, perhaps because that is when additional demands start being made of them. The fact that the deficits become relatively greater for foundation skills implies that those skills may be put to greater use after one has been on the job.

Each employee also reported on the percentage of time that the formal training programs they attended devoted to each of the SCANS skills. The rank order correlation (Spearman) between the distribution of time spent in training programs and skills importance as reported by supervisors was .70 (significant at the 1% level); the correlation with skill deficits reported by supervisors was -.45 (significant at the 10% level). It may be a rational strategy to devote training resources to the most important skills, but these results also suggest that the current distribution of training may do little to overcome skill deficits.

Skill Deficits and Individual Performance

The next analysis examines the relationship between these skill measures and individual performance. The performance measure is a single item asking the supervisor about "the overall performance of this employee" as compared to others that the supervisor has seen over the past 10 years (the 10-year comparison reduces the tendency to make each evaluation relative to the supervisor's current group of employees and to impose a distribution on the workforce). The skill measures are the supervisors' assessments of skill deficits summarized in Table 3. Skill deficits—situations where jobs require skills that workers do not have—represent a problem that should have an adverse effect on current performance.

Table 5 (see Appendix) identifies the variables used in the analysis of skill deficits and performance.[6] The *skills deficiencies* variable represents the overall score for the SCANS scale as a whole, while the foundation skills and workplace competencies variables represent the score for each subsection of the overall scale.

The results in Table 6 (see Appendix) suggest that there is a strong relationship between overall skill deficits and performance. The second equation suggests that this overall result is driven by deficits in foundation skills and not workplace competencies. The argument that the relationship between overall skill deficiencies and performance could be driven by common method variance (i.e., supervisors who believe that their workers perform poorly report that those workers are poor on everything, perhaps even reporting worse deficits as a means of justifying poor performance scores) is not consistent with the results in the second equation: Supervisors are not reporting greater deficits in workplace competencies where performance is worse. Indeed, the tendency is in the opposite direction.[7]

Skill Needs and Worker Outcomes

What happens to workers who find that they need more skills in order to improve their jobs? Does having an unmet demand for skill contribute to poor attitudes and performance, or does it suggest a challenge that provides the opportunity for growth in the job?

The study also examined the relationship between skill needs and job satisfaction, employee commitment, and organizational citizenship behavior, a measure of pro-social behavior, as reported for each employee by the supervisor.[8] The scales for each of these measures are reported in Table 9 (see Appendix).[9]

These relationships are reported in Table 7 (see Appendix). In brief, workers who report that they need more skills have higher satisfaction, commitment, and citizenship, suggesting that needing skills to improve performance (as opposed to skill deficits examined in Table 6) has positive effects on employee attitudes and behavior. When the two skill sets are examined separately, however, the significant relationships are all with foundation skills. Tests for causality by reversing the regressions (available on request) suggest that skill needs are driving these outcomes and not the reverse. In other words, being a satisfied, committed employee does not lead to greater skill needs but having greater skill needs does seem to lead to greater job satisfaction, commitment, and citizenship. Overall, these results seem to suggest that workers respond well to jobs that challenge their foundation skills.

Frustration With Skill Needs

If higher skill needs lead to better performance, then why should employers provide any skills at all—why not maximize the needs by restricting the supply of skills? This issue was examined with another variable that measures the difference between employees' perceptions of their skill needs and the training they received by the employer for each skill. As noted above, employees reported on the percentage of training they received that addressed each of the SCANS skills. (Ideally, one would have preferred

the actual amount of time spent in training on each skill, but only the distribution was available.) The responses to this scale and the skill needs scale were normalized, and a difference score was calculated for each skill item (the difference between needs and training time). The mean value of the difference score across all of the questions became the variable used in this analysis. This measure is considered to be an index of frustrated skill needs because it measures the extent to which employees have received help in meeting their skill needs.

The relationships between this measure of frustration and the dependent variables examined in Table 7 are reported in Table 8 (see Appendix). Overall, greater frustration as measured by this index is associated with lower outcomes on job satisfaction, commitment, and citizenship. No separate relationships were found for foundation skills and workplace competencies considered separately, presumably because of colinearity between them. But the results suggest that frustrating skill needs by a mismatch between training topics actually worsens performance. The results in Table 8 suggest, then, that employee outcomes are higher where jobs challenge skill needs and not where training mismatches frustrate perceived needs to improve skills.

CONCLUSION

The considerable attention given to potential relationships between skills, changing work organization, and economic performance has yet to be met by an equivalent outpouring of research on these relationships. The analysis presented here is one of very few such efforts. It indicates in particular the importance of basic academic or foundation skills to job performance. These skills are perceived as more important for improving performance by both employees and supervisors—deficits in them are associated with poorer overall job performance, while the perceived need to improve these skills is associated with more positive attitudes and behaviors.

In terms of the policy arguments noted earlier, the results here support arguments suggesting that improving the skills of the workforce—the basic foundation skills in particular—can improve job performance.

ENDNOTES

1 The fact that the relationship was positive for workers who had spent five years or more with an employer may suggest that the problem is one of information: Employers may be better able to identify and value competencies, matching worker skills with tasks, after they have experience with the workers. Presumably, employers could also have used the Armed Services Vocational Aptitude Battery to make these assessments if the information was valuable. Another interpretation is that entry-level jobs did not require these skills while the jobs that workers held five years later did.

2 The United States Assessment of Vocational Education of 1994 urged that vocational education be viewed in part as a vehicle for teaching academic skills and called for the integration of academic and vocational curricula.

3 By analogy, skill needs are the reduced form of functions for the supply of and demand for skills. See Goldstein, Braverman, and Goldstein (1991) for a review of needs assessment methods.

4 The original list contained 10 job titles. Despite the fact that the companies themselves prepared the list of benchmark jobs, not every company had every job on the list. Therefore, 5 additional job titles were included to cover positions at those companies with missing jobs. The new jobs were similar in content to the ones that were missing. The average company reported on 11 jobs, which explains why there are 91 supervisors surveyed and not 120—15 jobs times eight companies.

5 The one exception is the supervisors' ranking of "the ability to work with others," which they rank as eleventh in importance even though they rank "the ability to work in teams" first in importance. Perhaps the supervisors see working with others as relationships outside of the team they supervise. Perhaps these relationships are seen as secondary to the work effort and predominantly social in nature. The rank order correlation (Spearman) between the employee and supervisor responses was .51, significant at the 10% level.

6 While performance measures were requested for each employee, skill deficits were requested of the group of employees that the respondent directly supervised. In most cases, the supervisors reported on all of their employees, so this group measure is the average score for the employees whose performance was evaluated.

7 This relationship was also examined with the performance measure and the other independent variables aggregated to the group level consistent with the skill deficit measure. The results of weighted least square regressions are virtually the same despite the smaller sample size ($n = 91$). Ordered probit estimates of the relationships in Table 6 are available on request.

8 The relationship with the overall performance measure reported in Table 6 was also studied, but that relationship is conceptually unclear because the skill needs questions are asked in the context of improving performance. Poor performers may see the greatest need to improve their performance; alternatively, good performers who are most interested in becoming better may report the greatest skill needs. Either effect may obscure potential relationships with skill needs per se. The results, available from the authors on request, show no relationship between skill needs and performance and a very weak overall model. Perhaps the two effects noted above cancel each other.

9 The satisfaction scale is the Minnesota Job Satisfaction Index (see Gibson, Weiss, Dawis, & Lofquist, 1970); the commitment scale is a shortened version of the 15-item scale introduced by Mowday, Steers, and Porter (1979); and the citizenship scale is a shortened version of the one developed by Podsakoff and MacKenzie (1989). Cronbach's alpha coefficient of reliability for each scale is .84, .83, and .78, respectively.

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APPENDIX: TABLES

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Table 1

Needs for Training (Perception of the Importance of the Training & Development of Skills)

Skill	Mean	Std.	Rank	Group mean	Group rank
Foundation skills:				3.8583	1
Basic reading & mathematical skills	3.8259	1.5312	5		
Communication skills—speaking, listening, writing	3.8428	1.1626	3		
Thinking skills—problem solving, reasoning, thinking creatively	3.9461	1.1621	1		
Personal qualities—responsibility & self-management	3.8182	1.1497	6		
Workplace competencies:				3.5577	2
The ability to work with others	3.9383	1.1450	2		
The ability to work in teams	3.8305	1.1859	4		
The ability to teach	3.4684	1.2568	9		
The ability to allocate material, money, space, or staff	2.9137	1.4322	11		
The ability to acquire & evaluate data, interpret & communicate findings from data	3.6656	1.2225	7		
The ability to understand systems of technology or organization, make changes, & improve such systems	3.6317	1.2626	8		
The ability to select appropriate equipment and tools, apply to specific tasks	3.4561	1.3534	10		

Note. 1 = very unimportant; 5 = very important.

Table 2

Supervisors' Ranking of the Importance of the Following Skills

Skill	Mean	Std.	Rank	Group mean	Group rank
Foundation skills:				4.5747	1
Basic reading & mathematical skills	4.4545	0.7529	5		
Communication skills—speaking, listening, writing	4.6623	0.6201	3		
Thinking skills—problem solving, reasoning, thinking creatively	4.6883	0.5907	2		
Personal qualities—responsibility & self-management	4.4935	0.7000	4		
Workplace competencies:				4.0638	2
The ability to work with others	3.5844	1.2068	11		
The ability to work in teams	4.7272	0.6200	1		
The ability to teach	4.4473	0.8547	6		
The ability to allocate material, money, space, or staff	3.8441	0.9041	9		
The ability to acquire & evaluate data, interpret & communicate findings from data	4.1818	0.8695	7		
The ability to understand systems of technology or organization, make changes, & improve such systems	3.9605	0.8861	8		
The ability to select appropriate equipment and tools, apply to specific tasks	3.7013	1.1363	10		

Note. 1 = very unimportant; 5 = very important; n = 91.

Table 3

Supervisors' Ranking of the Deficiencies of Their Immediate Subordinates' Skills

Skill	Mean	Std.	Rank	Group mean	Group rank
Foundation skills:				2.4894	2
Basic reading & mathematical skills	2.4675	0.8364	7		
Communication skills—speaking, listening, writing	2.6753	0.8950	3		
Thinking skills—problem solving, reasoning, thinking creatively	2.3947	0.8956	10		
Personal qualities—responsibility & self-management	2.3421	0.7925	11		
Workplace competencies:				2.6530	1
The ability to work with others	2.6986	0.7938	2		
The ability to work in teams	2.4079	0.8355	9		
The ability to teach	2.4400	0.8889	8		
The ability to allocate material, money, space, or staff	2.8947	0.8881	1		
The ability to acquire & evaluate data, interpret & communicate findings from data	2.4933	0.8443	6		
The ability to understand systems of technology or organization, make changes, & improve such systems	2.6710	0.8064	4		
The ability to select appropriate equipment and tools, apply to specific tasks	2.5733	0.7914	5		

Note. 1 = outstanding; 5 = very deficient; n = 91.

Table 4

Plant Manager Survey (Means) Question: What Deficiencies Do You See in The Employees?

Employee	Foundation skills	Workplace competencies
New hires (employees with less than 2 years service)	2.17	2.15
Veterans (employees with at least 2 years service)	2.42	2.26

Note. 1 = no deficiencies; 5 = serious deficiencies; n = 95.

Table 5

Means and Standard Deviation of the Variables Used in the Models

Variable	Mean	Std.
Age (years)	44.14	54.22
Level of education (1 = some high school; 6 = four-year college)	3.66	1.51
Sex (1 = male; 2 = female)	1.24	0.45
Time spent at present company (years)	15.00	9.27
Age when one began working full time (years)	19.76	3.87
Size of work group (number of employees)	5.82	2.91
Skills' deficiencies (1 = outstanding; 5 = very deficient)	2.56	0.63
Foundation skills deficiencies (1 = outstanding; 5 = very deficient)	2.49	0.71
Workplace competencies deficiencies (1 = outstanding; 5 = very deficient)	2.65	0.64
Performance (1 = very poor; 5 = very good)	3.71	0.52

Table 6

Regression Coefficients

Dependent Variable - Performance	Equation 1	Equation 2
Age (years)	0.0001 (0.35)	0.0005 (0.20)
Level of education (1 = some high school; 6 = four year college)	0.0100 (0.73)	0.0125 (0.93)
Sex (1 = male; 2 = female)	0.0089 (0.21)	-0.0317 (-0.73)
Time spent at present company (years)	0.0068** (2.32)	0.0072** (2.54)
Age when one began working full time (years)	-0.0061 (-1.27)	-0.0071 (-1.51)
Size of work group (number of employees)	0.0319*** (2.88)	0.0347*** (3.20)
Skills' deficiencies (1 = outstanding; 5 = very deficient)	-0.2051*** (-6.56)	
Foundation skills deficiencies (1 = outstanding; 5 = very deficient)		-0.2641*** (5.85)
Workplace competencies deficiencies (1 = outstanding; 5 = very deficient)		0.0595 (1.24)
F value	8.97	10.67
R-square-adj.	.14	.18
n	91	91

Note: * $p < .1$; ** $p < .05$; *** $p < .01$.

Table 7

Skills Needs

	REGRESSION COEFFICIENTS Dependent variables					
	Organizational citizenship behavior (OCB)		**Organizational commitment**		**Job satisfaction**	
	(1)	(2)	(1)	(2)	(1)	(2)
Intercept	2.7862*** (15.71)	2.7855*** (15.71)	2.8568*** (14.97)	2.8558*** (14.98)	2.7195*** (16.26)	2.6842*** (16.09)
Age	-0.0004 (-0.81)	-0.0004 (-0.75)	-0.0008 (-1.60)	-0.0008 (-1.53)	-0.0014*** (-3.20)	-0.0014*** (-3.14)
Level of education	0.0366** (2.14)	0.0386** (2.25)	0.0254 (1.38)	0.0281 (1.52)	0.0360** (2.19)	0.0416** (2.57)
Sex	0.1632*** (2.80)	0.1527*** (2.59)	0.2087*** (3.32)	0.1943*** (3.07)	0.1444*** (2.63)	0.1326** (2.39)
Time spent at present company	0.0067** (2.29)	0.0064** (2.18)	0.0060* (1.93)	0.0057* (1.80)	0.0087** (2.30)	0.0071** (2.58)
Company A (dummy)	0.7161*** (6.08)	0.7150*** (6.07)	0.7212*** (5.69)	0.7197*** (5.68)	0.5434*** (4.89)	0.5675*** (5.12)
Company B (dummy)	0.2917** (2.41)	0.2944** (2.44)	0.2283* (1.75)	0.2320* (1.78)	0.3097*** (2.73)	0.3247** (2.85)
Company C (dummy)	0.2670** (2.22)	0.2672** (2.22)	0.2826** (2.18)	0.2829** (2.19)	0.1135 (1.01)	0.1180 (1.04)
Company D (dummy)	0.5274*** (4.28)	0.5281*** (4.23)	0.5413*** (4.08)	0.5423*** (4.09)	0.5436*** (4.66)	0.5763*** (4.97)
Company E (dummy)	0.3350*** (2.69)	0.3326*** (2.67)	0.3625*** (2.71)	0.3594*** (2.69)	0.2588** (2.21)	0.2572** (2.20)
Company F (dummy)	0.2494 (2.06)	0.2447** (2.02)	0.2613** (2.01)	0.2548* (1.96)	0.1228 (1.07)	0.1520 (1.33)
Company G (dummy)	0.1350 (0.96)	0.1427 (1.02)	0.0778 (0.52)	0.0884 (0.59)	0.2403** (1.82)	0.2664** (2.02)
Company H (dummy)	-0.0714 (-0.60)	-0.0711 (-0.60)	-0.1399 (-1.09)	-0.1394 (-1.09)	0.1359 (1.21)	0.1290 (1.15)
General perception of the importance of training	0.0759*** (2.69)	-	0.0658** (2.17)	-	0.0558** (2.11)	-
Perception of the importance of the training aimed at the development of:						
Foundation skills	-	0.1001*** (2.64)	-	0.0982** (2.57)	-	0.0863** (2.35)
Workplace competencies	-	-0.0072 (-0.01)	-	-0.0092 (-0.26)	-	-0.0098 (-0.29)
R-square-adj.	0.14	0.15	0.15	0.15	0.12	0.12

Note: * p < .1. ** p < .05. *** p < .01.

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Table 8

Frustration With Skills Needs

	REGRESSION COEFFICIENTS Dependent variables					
	Organizational citizenship behavior (OCB)		**Organizational commitment**		**Job satisfaction**	
	(1)	(2)	(1)	(2)	(1)	(2)
Intercept	2.4927*** (3.43)	2.4947*** (3.43)	2.7453*** (4.20)	2.7325*** (4.12)	2.8166*** (4.82)	2.8410*** (4.87)
Age	0.0001* (2.44)	0.0118* (2.43)	0.0103* (2.37)	0.0102* (2.34)	0.0041 (1.06)	0.0044 (1.14)
Level of education	0.0555** (3.14)	0.0554** (2.56)	0.0324* (1.67)	0.0332* (1.70)	0.0439** (2.54)	0.0421** (2.42)
Sex	0.1023 (1.39)	0.1021 (1.38)	0.1292* (1.95)	0.1299* (1.96)	0.1359** (2.30)	0.1337** (2.27)
Time spent at present company	-0.0028 (-0.55)	-0.0029 (-0.56)	-0.0022 (-0.47)	-0.0021 (-0.44)	0.0017 (0.42)	0.0013 (0.32)
Company A (dummy)	0.7487 (1.05)	0.7450 (1.04)	0.7117 (1.10)	0.7219 (1.12)	0.4588 (0.80)	0.4 31 (0.75)
Company B (dummy)	0.3771 (0.52)	0.3944 (0.54)	0.2497 (0.38)	0.2634 (0.41)	0.2086 (0.36)	0.1750 (0.31)
Company C (dummy)	0.3418 (0.47)	0.3393 (0.47)	0.3252 (0.50)	0.3390 (0.52)	0.0360 (0.06)	0.0021 (0.01)
Company D (dummy)	0.6019 (0.84)	0.5981 (0.83)	0.5789 (0.90)	0.5903 (0.92)	0.4477 (0.78)	0.4171 (0.73)
Company E (dummy)	0.4429 (0.69)	0.4406 (0.67)	0.3509 (0.54)	0.3597 (0.56)	0.1791 (0.31)	0.1557 (0.27)
Company F (dummy)	0.2394 (0.36)	0.2247 (0.36)	0.2807 (0.43)	0.2946 (0.46)	0.0667 (0.11)	0.0338 (0.05)
Company G (dummy)	0.2650 (0.36)	0.2627 (0.37)	0.1920 (0.29)	0.2054 (0.32)	0.1617 (0.28)	0.1266 (0.22)
Company H (dummy)	-0.0958 (-0.13)	-0.0984 (-0.14)	-0.0840 (-0.13)	-0.0708 (-0.09)	0.0214 (0.03)	-0.01130 (-0.02)
General frustration with skill needs	-0.0087*** (-2.59)	-	-0.0082*** (-2.72)	-	-0.0075** (-2.81)	-
Frustration with the needs for:						
Foundation skills	-	-0.0033 (-0.91)	-	-0.0018 (-0.53)	-	-0.0057 (-0.90)
Workplace competencies	-	-0.0054 (-0.91)	-	-0.0062 (-0.57)	-	-0.0025 (-0.92)
R-square-adj.	0.15	0.16	0.15	0.15	0.12	0.12

Note: * $p < .1$; ** $p < .05$; *** $p < .01$.